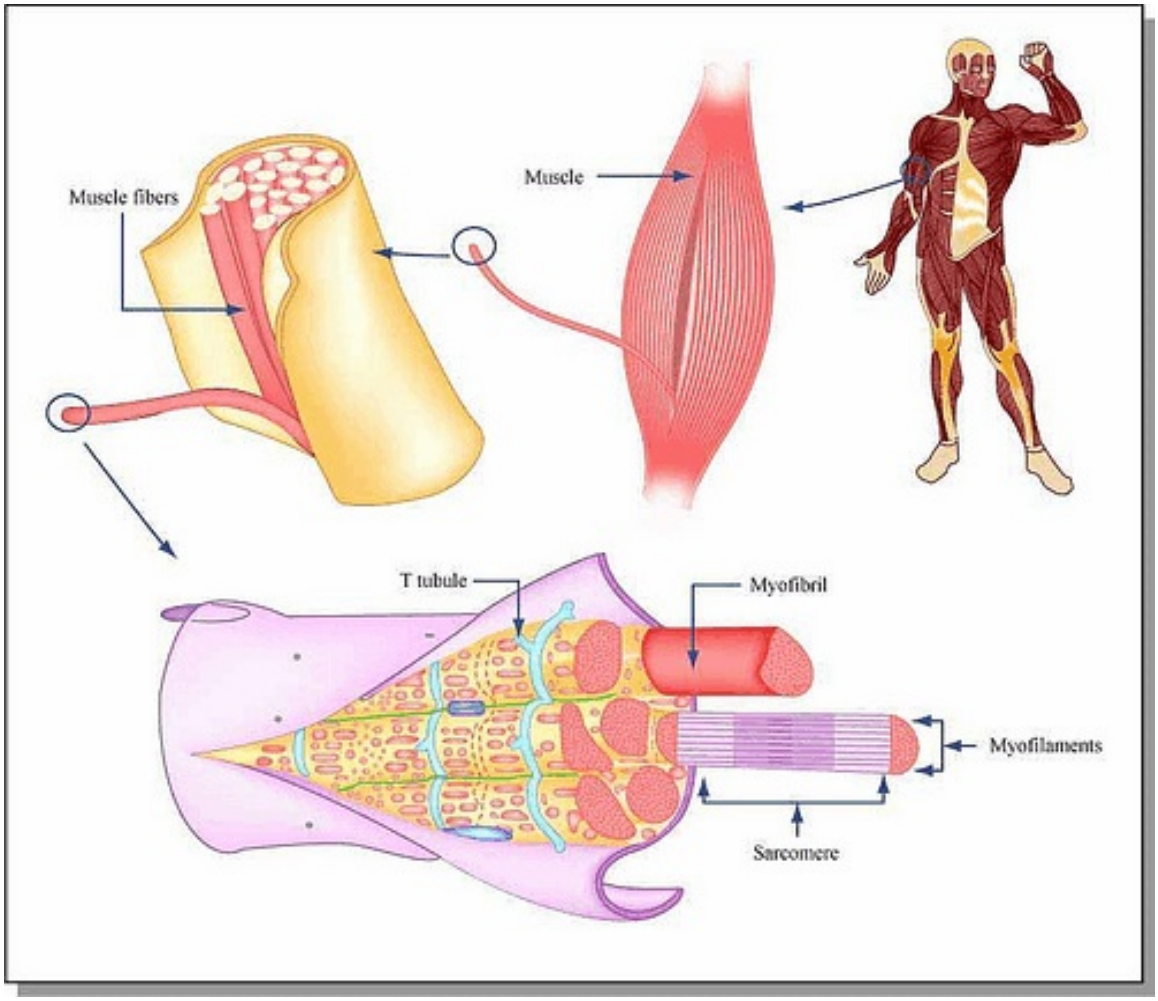
The Anatomy of a Muscle

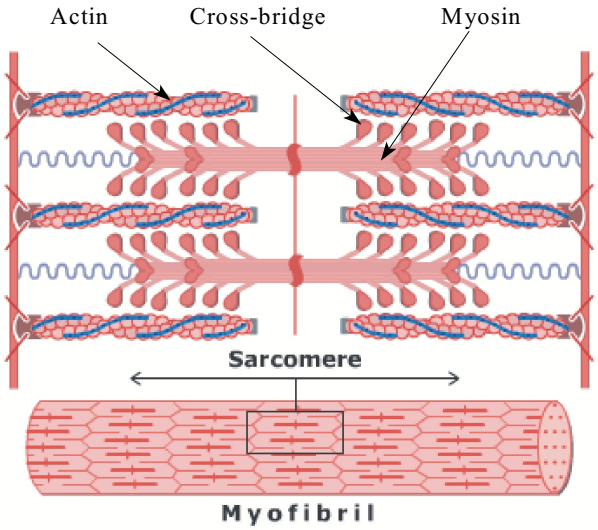
Skeletal muscle is made up of thousands of cylindrical muscle **fibers** often running the entire length of a muscle. The longest muscle fibers found in the body are in the sartorius muscle and are up to 30 cm in length. Muscle fibers are wrapped together in connective tissue with blood vessels (arteries and veins) and nerves.
Muscles can only pull, so they must work in pairs. For example, the biceps muscle flexes the elbow and the triceps muscle extends the elbow. Without the triceps muscle as a partner, your arm would be permanently bent. When one muscle contracts, its partner relaxes.

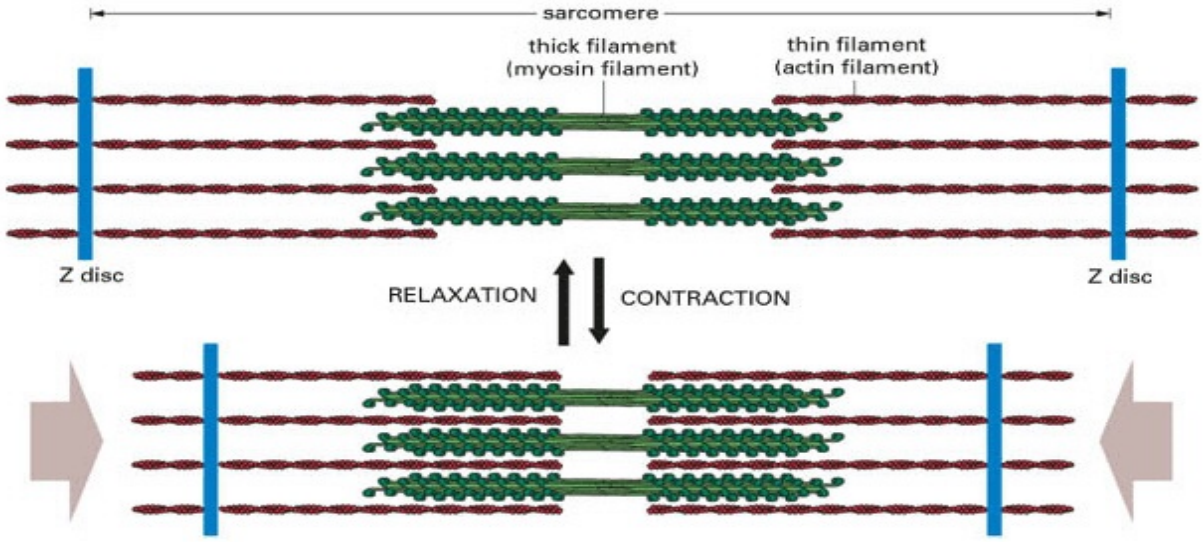


A muscle fiber is made up of even smaller groups called myofibrils. These in turn are made up myofilaments which create the smallest contractile unit of muscle called a **sarcomere**. The sarcomere is where the action of a muscle actually happens. Billions of sarcomeres are connected together like a long train and when each small unit contracts the entire muscle shortens in length and pulls on a bone.

A sarcomere is made up of two different protein chains (myofilaments): **Actin** and **Myosin**. These are also refered to as the thin (actin) and thick (myosin) filaments.

The thick myosin filaments contain projections called crossbridges that look like oars on a boat. These "oars" reach out and attach to the actin and pull like rowers in a race. As they continue to pull over and over again the actin slides along making the muscle shorten. This is called the **sliding filament theory**. A good animation of this can be found on-line at:
http://www.youtube.com/watch?v=EdHzKYDxrKc&NR=1
http://www.youtube.com/watch?v=Vlchs4omFDM&NR=1
Check some related videos for a better understanding.





Muscle Fiber types

Muscle fibers come in many different shapes and sizes. There are two main types of muscle fibers: Type 1 (slow-twitch) and Type 2 (fast-twitch).

	Type 1	Type 2
Size	Smaller in diameter ●	Larger in diameter ●
Energy Source	Uses oxygen to produce energy	Uses creatine phosphate to produce energy
Endurance	Resistant to fatigue	Fatigue easily and produce lactic acid waste
Activites	Long duration/slow movement activities	Short duration/fast movement activities

The Anatomy of a Muscle - Questions

1. In which muscle are the longest muscle fibers in the body found? Where on the body is this muscle located (you will need to do some research here)?

2. Use the first diagram to fill in the missing muscle structures, from largest to smallest.

Muscle → _____ → _____ → Myofilaments → _____
(Actin, Myosin)

3. What is the contractile unit of a muscle called?

4. What are the two types of protein the myofilaments are made from?

5. Describe how a muscle shortens in length.

6. Muscle groups work in pairs, why is it important to train both muscles in a pair instead of just one?

7. For each activity listed below, state the muscle fiber type that would be predominantly used (Type 1 (slow) or Type 2 (fast).

Activity	Fiber Type
2 km swim	
triathlon	
100 meter sprint	
weight training	
basketball	
boxing	
soccer	
long jump	